

SHATTUCK FACT SHEET

The Shattuck Chemical Superfund Site (Shattuck or the Site) is Operable Unit VIII of the larger Denver Radium Superfund Sites, consisting of 65 properties abandoned after the city's radium industry collapsed in the 1920's. The Site is located approximately 6 miles southwest of downtown Denver, Colorado (Figure 1). The S.W. Shattuck Chemical Company processed a variety of radioactive materials at the site from 1917 to 1984. Radionuclides of concern at the Site are radium-226 (Ra-226), thorium-230 (Th-230), and natural uranium (U-nat). Processed ore wastes (soil and rubble) remained at the Site at the time of its closure.

After the completion of a Remedial Investigation in 1991, remedial actions were implemented at the Site as specified in the Superfund *Record of Decision* (ROD) *Denver Radium Site, Operable Unit VIII, Denver, Colorado* (United States Environmental Protection Agency [USEPA] and Colorado Department of Health [CDPHE], 1992). That action consisted of solidification of site soil and rubble with a mixture of concrete and fly ash and covering with a cap composed of clay material, geosynthetic liner, sand and gravel, and riprap to create a "monolith" at the site. That work was completed in 1997.

Subsequent to that action, an Amended ROD was promulgated for the site in June 2000 (USEPA, 2000a). The Amended ROD called for the removal and off-site disposal of the existing monolith. Additionally, contaminated soils beneath the monolith and along the perimeter of the site were also required to be removed. As part of the work the removal of contaminated soils from beneath the Bannock Street right-of-way (ROW) was also completed. The United States Army Corps of Engineers (USACE) was selected by the USEPA to manage the remediation effort.

In order to prevent exposure of the surrounding community to potentially contaminated dust that would be generated from demolition of the concrete monolith it was determined that demolition and loading of the monolith materials should be conducted in enclosed structures. Consequently, three structures were erected at the site to complete the work. Those structures included a Mining Structure within which the monolith would be demolished, a Conveyor Structure to transport the demolished monolith materials to a loading area, and a Loadout Structure in which the monolith materials would be loaded into railcars for transportation to an approved offsite landfill disposal facility. The relationship of these structures to one another is shown in Figure 2.

Because the monolith extended for a length of approximately 750 feet across the site it was found to be infeasible to erect a Mining Structure that would enclosed the entire monolith area. Consequently the concept of a “movable” Mining Structure was developed. The concept allowed for a smaller Mining Structure to be erected at one end of the monolith and proceed across the entire monolith in a series of “building moves”. When work to demolish the monolith was completed under each “setup” the Mining Structure was moved to the next “setup” and work would proceed to demolish and excavate the monolith materials under that building setup. To make this concept workable the Mining Structure was constructed on “wheels” that allowed the structure to be towed to each subsequent building setup. A total of ten building setups were required to complete the removal of the Shattuck monolith.

Work to construct the site facilities including the Mining, Conveyor, and Loadout Structures began in December 2002 and was completed in March 2003. Railcar shipments also began in March 2003. In the course of the work to complete the remediation of the monolith, perimeter soils, and the Bannock Street ROW a total of 2244 railcars containing approximately 243,101 tons of soil and monolith materials were delivered to the approved offsite disposal facility. The last railcar was shipped in July 2006, approximately 39 months after the first railcars were delivered.

When the excavation of monolith and affected underlying soil was completed in each building setup “survey units” were established on the newly excavated surface. The survey units were used to establish a sampling and analysis program to confirm that all radiologically affected material had been removed from beneath the footprint of that building setup. The procedures for conducting the Final Status Survey (FSS) sampling and analysis are detailed in the Final Status Survey Plan (FSSP). In addition to the FSS sampling Independent Verification, or IV sampling, was conducted by the Colorado Department of Public Health and Environment (CDPHE) on selected survey units to independently confirm that all radiologically affected materials had been removed from the Shattuck site in accordance with the Amended ROD criteria.

During execution of the work an extensive health and safety monitoring programs were implemented at the Shattuck site to monitor worker and community exposure. The program was conducted in accordance with various project work plans including the Chemical and Radiological Sampling, Analysis, and Data Quality Assurance Plan

(CRSADQAP), the Community Safety and Health Plan (CSAHP), and the Site Health and Safety Plan (SHASP).

Program components to monitor site worker health and safety included exposure to ionizing radiation, airborne total α -emitting radionuclides, airborne radionuclides, airborne metals, respirable dust, radon, silica, organic vapors, nitrogen oxides (NO_x), carbon monoxide (CO), and ammonia.

Over the lifetime of the project none of the workers was exposed to radiation above the allowable exposure rate of 2,500 microR per hour ($\mu\text{R/hr}$). Measurements in work areas associated with excavated material removal and storage in the Mining Structure typically varied from 18 to 20 $\mu\text{R/hr}$ based on background radioactivity of 11 $\mu\text{R/hr}$ and a 2000-hour work year.

No adverse affects to workers were identified from airborne metals, respirable dust, radon, silica, organic vapors, nitrogen oxides (NO_x), carbon monoxide (CO), or ammonia. In instances where transient conditions were identified that exceed regulatory guidelines temporary engineering controls or other safety actions were undertaken to mitigate the condition.

Program components to monitor community health and safety included the establishment of eight perimeter monitoring stations to monitor airborne emissions from the site. Samples were routinely collected from these stations and analyzed for Total Suspended Particulates (TSP), Airborne Radioactivity, and Airborne Metals. Results of the community monitoring program were shared with community representatives at quarterly Community Action Group (CAG) meetings. As shown in Figure 3 the community was not exposed to Total Suspended Particulates (TSP), Airborne Radioactivity, and Airborne Metals at concentrations exceeding regulatory standards.

Working in unison the USEPA, the CDPHE, the CAG, and the USACE and its contractor have successfully completed the remediation of the Shattuck Chemical Superfund Site. The cooperative effort of these organizations should be used as an example of the significant work that can be accomplished through these cooperative collaborations.